SECTION F

UDENT IDENTIFICATION NUMBER

Tests
L

Physics 30
1969

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DEPARTMENT
EDUCATION ALBERTA

HIGH SCHOOL AND UNIVERSITY MATRICULATION
EXAMINATIONS BOARD

DEPARTMENTAL EXAMINATIONS, 1969

PHYSICS 30

Time — 2 hours.

Total Possible Mark — 105.

DO NOT SPEND TOO MUCH TIME ON ANY ONE QUESTION.

READ THE QUESTIONS CAREFULLY.

NOTE — Answers to Questions 1 - 28 are to be recorded on the separate ANSWER SHEET provided.

Answers to questions 29 to 34 are to be recorded in this booklet. Rough work may be done in pencil, finished work must be done in blue or black ink (pen or ballpoint). Mathematical tables, slide rules and geometry sets may be used.

PLEASE REFER TO PAGE 2 for INSTRUCTION RE COMPLETION OF ANSWER SHEET.

To ensure accuracy in the handling of your examination booklet, Section E below, and Section F above, MUST BE COMPLETED in the following manner:

SECTION E — *Step (1)* *Carefully check label.* Notify the presiding examiner if the name on the label does not correspond to your name.

Step (2) Place label into the dotted box.

Step (3) Indicate your name, mailing address and birth date whether or not you have a label.

SECTION F — From the label, write your student number in the area designated. IF NO LABEL HAS BEEN PROVIDED, omit Section F.

Machine Score

Book Score

TOTAL

(For the use of the Department only)

PLACE RED SEAL HERE

SEAL this booklet upon completion of examination. DO NOT FOLD EITHER THE ANSWER SHEET OR THE TEST BOOKLET. Your presiding examiner will collect the answer sheet and booklet separately for transmission to the Department.

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Place label in dotted box

SECTION E

The following information must be given:

Name ....
Surname Christian Names

Mailing Address ....
City, Town, Village

Birth Date ....
Day Month Year

To ensure accuracy in the handling of your examination papers, the following sections on your answer sheet MUST BE COMPLETED.

SECTION A — Supply information as requested.

SECTION B — *Step (1)* *Carefully check label.* Notify the presiding examiner if the name on the label does not correspond to your name.

Step (2) Place label into the dotted box.

Step (3) Indicate your name, mailing address and birth date whether or not you have a label.

SECTION C — Supply information as requested.

SECTION D — *Step (1)* From the label, write your student number into the column of blank boxes in Section D. Begin by placing the left-most digit into the top box.

Step (2) For the digit you have placed into each box, blacken the appropriate guide line containing this digit.

IF NO LABEL HAS BEEN PROVIDED, omit Section D.

ROUGH WORK ONLY

(No marks given for work in this space)

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QUAECUMQUE VERA

Questions 1 to 28 inclusive, have a value of two marks each. In each case select the BEST of the four answers and record your choice on the SEPARATE ANSWER SHEET PROVIDED.

EXAMPLE	ANSWERS	ANSWER SHEET
If an object has a speed of 4.0 ft/sec, how far will it travel in 10 sec?	A. 20 ft B. 40 ft C. 60 ft D. 80 ft	A ☐ B ■ C ☐ D ☐ E ☐ DISREGARD COLUMN "E" ON ANSWER SHEET

You are to use an ORDINARY HB PENCIL to mark your answers on the answer sheet. Make certain your answer marks are heavy and black. If you change your mind about a question, it is essential that you erase your first mark completely. There should be only one answer marked for each question. Be sure there are no stray pencil marks on your answer sheet.

CONSTANTS:

$g = 9.8 \text{ m/sec}^2 = 32 \text{ ft/sec}^2$

$1 \text{ hp} = 550 \text{ ft} \cdot \text{lb/sec} = 746 \text{ W}$

$c = 3.00 \times 10^8 \text{ m/sec}$

$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$

$1 \text{ C} = 6.24 \times 10^{18}$ electrons

1. A pilot in a plane heads due north at 1.2×10^2 mph. If there is a 50 mph wind blowing from the east, find the speed of the plane with respect to the ground.

1. A. 1.3×10^2 mph
B. 1.1×10^2 mph
C. 70 mph
D. 1.7×10^2 mph

2. Different scales were used to make the following measurements. Which one of the measurements was made using a scale marked in millimeters?

2. A. 1.60 m
B. 1.600 m
C. 1.6000 m
D. 1.60000 m

3. A ball which is projected horizontally is observed to reach the ground in the same time as a ball dropped simultaneously from the same point. This observation supports one of the following statements:

3. A. at high speeds air resistance influences the motion of a projectile measurably
B. both balls were moving at the same speed
C. the horizontal motion is independent of the vertical motion
D. the distance travelled varies directly as the time

4. An object is projected upward at an angle of 30° with the horizontal and at a speed of 160 ft/sec. How long does it take to reach its maximum height?

4. A. 1.2 sec
B. 10 sec
C. 5.0 sec
D. 2.5 sec

ROUGH WORK ONLY

(No marks given for work in this space)

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5. A body weighs 200 lb on the earth. What would it weigh on a planet whose mass is four times that of the earth and whose diameter is four times that of the earth?

5.
A. 12.5 lb
B. 50.0 lb
C. 200 lb
D. 400 lb

6. The largest force of the following is

6.
A. 1.0 kgf
B. 2.0 lb
C. 10^5 dynes
D. 10 N

7. A frictionless pulley wheel is suspended from the ceiling. A cord over the pulley has a weight of 150 lb on one end and a weight of 250 lb on the other end. Find the acceleration of the 250 lb weight.

7.
A. 0.25 ft/sec^2 downward
B. 13 ft/sec^2 downward
C. 0.078 ft/sec^2 downward
D. 8.0 ft/sec^2 downward

8. How much work is done by a force of 50 newtons applied through a distance of 10 m in 5.0 sec?

8.
A. 25 J
B. 1.0×10^2 J
C. 5.0×10^2 J
D. 2.5×10^3 J

9. What is the speed of an earth satellite launched into a circular orbit 400 mi above the earth's surface? Assume that the radius of the earth is 4000 mi and that the acceleration due to gravity at the altitude of the orbit is 27 ft/sec^2.

9.
A. 2.5×10^4 ft/sec
B. 3.5×10^2 ft/sec
C. 2.0×10^3 ft/sec
D. 1.5×10^5 ft/sec

10. What is the kinetic energy of a mass of 2.0 slugs that has fallen 8.0 ft starting from rest? (Assume that g is 32 ft/sec^2)

10.
A. 0.50 ft • lb
B. 8.0 ft • lb
C. 16 ft • lb
D. 5.1×10^2 ft • lb

11. A mass of 2.0 kg starts from rest at the top of an inclined plane 2.5 m high and 4.0 m long. What is its speed at the bottom of the plane if one-half of the energy that it had at the top of the plane is wasted in overcoming friction?

11.
A. 1.6 m/sec
B. 5.0 m/sec
C. 3.9 m/sec
D. 6.3 m/sec

12. A 20 g bullet is shot vertically upward with 3.6×10^3 J of kinetic energy. How high will it rise?

12.
A. 3.0×10^1 m
B. 3.0×10^2 m
C. 1.8×10^4 m
D. 1.8×10^5 m

13. Two forces of 60 lb each, acting at the same point, make an angle of 120° with each other. What is the magnitude of their resultant force?

13.
A. zero
B. 60 lb
C. 30 lb
D. 1.2×10^2 lb

14. A 2.0 lb object slides down a frictionless incline which makes an angle of 30° with the horizontal. Find its speed after sliding for 8.0 ft.

14.
A. 16 ft/sec
B. 21 ft/sec
C. 22 ft/sec
D. 8.0 ft/sec

ROUGH WORK ONLY

(No marks given for work in this space)

15. To give an alpha particle 4.50 MeV of kinetic energy would require a potential difference of

15. A. 2.25×10^{-6} V
B. 2.25×10^{6} V
C. 9.00×10^{6} V
D. 4.50×10^{6} V

16. If 0.02 J of work is done in moving a 50 microcoulomb charge from point A in an electric field to point B, what is the potential difference between the two points?

16. A. 2.5×10^{3} V
B. 4.0×10^{-4} V
C. 4.0×10^{2} V
D. 4.0×10^{10} V

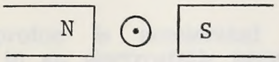
17. The force on a charge of 1.0 C placed 3.0 cm from a charged object A is 0.080 N. The force on the charge if it is moved to a position 4.0 cm from A will be

17. A. 0.045 N
B. 0.060 N
C. 0.10 N
D. none of these

18. The capacitance of a capacitor is 6.0×10^{-5} F. When the potential difference is 50 V, what is the charge on the capacitor?

18. A. 3.0×10^{3} C
B. 3.0×10^{-3} C
C. 8.3×10^{5} C
D. 3.0×10^{2} C

19. The electron in the diagram below is coming out of the paper at right angles to the field. As it passes between the poles of the magnet it is deflected



19. A. down
B. to the right
C. up
D. to the left

20. The force on a charge of 50 microcoulomb moving perpendicularly across a magnetic field at 20 m/sec is 2.5×10^{-4} N. What is the flux density of the magnetic field?

20. A. 2.5×10^{-2} T
B. 2.5×10^{-13} T
C. 2.5×10^{-1} T
D. none of these

21. The aurora borealis is caused by

21. A. weather disturbances
B. the earth's fluctuating magnetic field
C. lunar reflection on arctic ice
D. charged particles entering the atmosphere

22. A wire 5.00 m long carries a current of 10.0 A. If the wire experiences a force of 12.5 N when placed in a magnetic field then the flux density of the field is

22. A. 6.25×10^{2} T
B. 2.50×10^{-1} T
C. 6.25×10^{-3} T
D. 2.50 T

ROUGH WORK ONLY
(No marks given for work in this space)

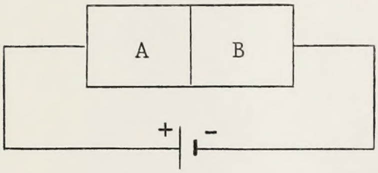
23. A generator produces an alternating potential difference at its terminals which when it is maximum has an instantaneous value of 150 V. If a 20.0 ohm resistor is connected across the terminals, what is the EFFECTIVE value of the current through the resistor?

23.
A. 5.30 A
B. 7.50 A
C. 10.7 A
D. 3.75 A

24. A falling drop of oil weighs 40.0 micrograms. When it reaches its terminal velocity, the retarding force is

24.
A. 3.92×10^{-7} N
B. 3.92×10^{-4} N
C. 4.08×10^{-6} N
D. 3.92×10^{-1} N

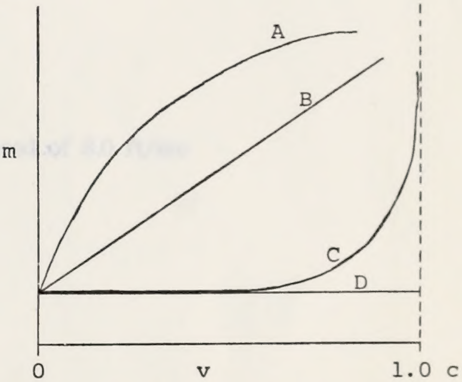
25. A is germanium doped with aluminum. B is germanium doped with arsenic. (Al is in Group III, Ge in Group IV and As in Group V of the periodic table.) Which of the following statements is true?



25.
A. B is a p-type semi-conductor
B. electrons flow from A to B across the junction
C. electrons flow from B to A across the junction
D. no current flows in the circuit

26. A proton is accelerated from rest in an electrostatic generator. Which of the following graphs most nearly represents the correct relationship between its mass (m) and speed (v)?

26.



27. How much energy is produced by the conversion of 0.250 g of mass?

27.
A. 2.25 J
B. 7.50×10^{8} J
C. 5.35×10^{19} J
D. 2.25×10^{13} J

28. Two objects having charges of 50 microcoulomb and 20 microcoulomb are 2.0 m apart. The force between them is $\left(k = 9.0 \times 10^{9} \frac{\mathrm{N \cdot m^2}}{\mathrm{C^2}}\right)$

28.
A. 2.2×10^{14} N
B. 2.2×10^{-2} N
C. 2.2×10^{10} N
D. 2.2 N

ROUGH WORK ONLY
(No marks given for work in this space)

Values

In questions 29 to 34 COMPLETE SOLUTIONS must be shown in the spaces provided.

29. A 160 lb man is standing on the floor of an elevator cage. Calculate the force the floor exerts on the man under each of the following conditions:

4 (a) the elevator has a downward acceleration of 8.0 ft/sec^2

1 (b) the elevator has a constant upward speed of 8.0 ft/sec

1 (c) the elevator cable snaps and the elevator falls freely

ROUGH WORK ONLY

(No marks given for work in this space)

Values

5 **30.** A 0.20 kg metal block is placed on a horizontal board 1.0 m long. The board is slowly tilted upward until the block just starts to move. Find the coefficient of friction between block and board if the raised end is 0.60 m above the initial position.

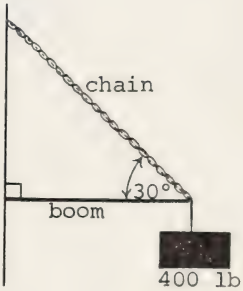
ROUGH WORK ONLY

(No marks given for work in this space)

Values

7 **31.** A 3000 lb car travelling at 60 mph due east hits a 8000 lb truck travelling at 30 mph due north on an icy crossroad. The two lock together and skid with negligible friction. Find the magnitude and direction of the velocity of the combined wreck.

6 **32.** The uniform boom shown in the diagram weighs 100 lb and is 10 ft long. The chain makes an angle of 30° with the boom and the load at the end is 400 lb. What is the tension in the chain? (Neglect the mass of the chain)



ROUGH WORK ONLY

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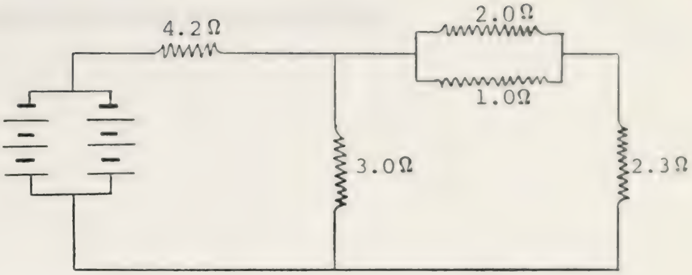
Values

33. The battery shown in the diagram consists of two parallel banks of three cells each. Each cell has an emf of 2.0 V and an internal resistance of 0.20 ohms.



2 (a) Find the emf of the battery.

2 (b) Find the internal resistance of the battery.

6 (c) Calculate the current through the 4.2 ohm resistor.

ROUGH WORK ONLY

(No marks given for work in this space)

Values

2 (d) Find the terminal potential difference of the battery.

2 (e) Calculate the current through the 2.0 ohm resistor.

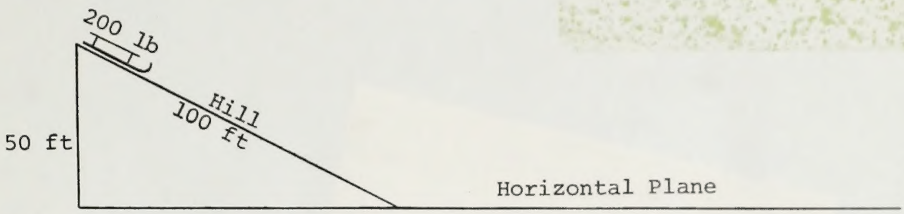
1 (f) Calculate the potential difference across the 4.2 ohm resistor.

ROUGH WORK ONLY

(No marks given for work in this space)

Values

34. A 200 lb sled is held at rest 100 ft from the bottom of a hill measured along the slope. The hill rises 50 ft for every 100 ft of slope. The surface of the hill and the horizontal plane at the bottom of the hill is covered with packed snow. The coefficient of kinetic friction between the sled and the snow is 0.29.



4 (a) If the sled is released, what kinetic energy will it have at the foot of the slope?

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Values

4 (b) How far will it travel along the horizontal before coming to rest?

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